

dwell on the limitations of German scientific work in its useless elaboration of details, its devotion to the accumulation of mere data, and its purely material objects and results; and when he claims for France a greater number of discoveries of the first rank, a greater love of knowledge for its own sake, we can heartily agree. "The bright sunlight," he says characteristically, "which illumines the footsteps of Descartes, Lavoisier, and Pasteur will indeed be obscured, if the fogs which rise from the plains of Germany come our way."

We may also quote the author's plea for a minimum of State interference. "Discoveries," he says, "are not made by the stroke of a magician's wand. *L'esprit souffle où il veut*. What the State should provide for the savant is the *means* for research. It should not impose methods or predetermined ideas; otherwise all initiative will be stifled." We may join with M. Wery in hoping that his plea in the interests of the extension of scientific research in agriculture in France will prove successful. The country which produced a Boussingault and a Pasteur must not be suffered to lag behind.

NOTES.

In the course of his statement on the Army Estimates, in the House of Commons on February 20, Mr. Macpherson directed attention to the health of the troops in the various theatres of war. In the Napoleonic campaigns 97 per cent. of the total deaths were from disease and only 3 per cent. were on the battlefield. In the South African campaign 67,000 cases of disease were admitted into hospital, of whom more than 8000 died. In France up to November last the deaths from disease were only one-fourth of the number that died from the same cause in South Africa. In Macedonia conditions are not so satisfactory, but as a result of the hygienic measures taken the amount of sickness in 1917 was reduced to two-thirds, and the death-rate to one-third, of what it was in 1916. A well-deserved tribute was paid to the Army Medical Service and to the services which had been rendered by the retiring Director-General, Sir Alfred Keogh.

DR. FLEMING SANDWITH, C.M.G., died suddenly and unexpectedly on February 17. He was in his sixty-fourth year, and had been invalided home after two strenuous years in Egypt. Few civilian medical men could show such a record of military service. He had worked in the Turko-Serbian war of 1876, and in the Russo-Turkish war in the following years. He had been on Baker Pasha's staff, and was senior physician to the Imperial Yeomanry Hospital in the South African war. In December, 1915, he was appointed temporary colonel in the Royal Army Medical Service, and proceeded to Egypt, a country well known to him, for in 1883 he was appointed for preventive work there against cholera. In Egypt Dr. Sandwith remained many years engaged in sanitary work and private practice, acquiring a considerable reputation in tropical medicine. After the South African war he settled in London, and became lecturer in tropical diseases to St. Thomas's Hospital, physician to the Seamen's Branch Hospital, Albert Dock, and lecturer in the School of Tropical Medicine there. He was also Gresham professor of physic, and his lectures on such subjects as plague, Pasteur's life and work, insect carriers of disease, etc.,

were deservedly popular. A man of genial and kindly disposition, Dr. Sandwith will be missed by a wide circle of patients and acquaintances.

THE Minister of Reconstruction, Dr. Addison, has appointed an Advisory Council to assist him in considering the many proposals that come before his Department for review. The work of the Council is to be discharged through four sections, each of which will advise the Minister on specific questions referred to it by him within the general subjects allocated to the several sections, namely:—Section I.: Finance, transport, and common services; Section II.: Production and commercial organisation; Section III.: Labour and industrial organisation; Section IV.: Social development (including rural reconstruction). The Council at presents consists of thirty-seven members, among whom are the following:—Mr. C. R. W. Adeane, late president, Royal Agricultural Society; Sir Richard Glazebrook, director of the National Physical Laboratory; Mr. H. J. Mackinder; the Hon. E. G. Strutt, an authority on agricultural questions; and Prof. T. B. Wood, professor of agriculture, Cambridge University. Mr. Eustace Davies, of the Ministry of Reconstruction, has been appointed secretary to the Advisory Council. It is noteworthy that while engineering, agriculture, industry, labour, the law, finance, and politics all have their representatives, pure and applied science, other than engineering and agriculture, is represented by one member only. Presumably Section IV. will be concerned with such problems as the welfare of workers and housing for the people, yet there is not a single member representing medicine and hygiene or architecture.

SIR G. CAVE announced, in the House of Commons on February 20, that for the present year summer-time will be brought into force on the morning of Sunday, March 24, and will continue until the night of Sunday, September 29, an arrangement that will give an additional five weeks of summer-time this year. He added:—"As regards the suggestion that during the midsummer period the time should be advanced by an additional hour, there is no power under the statute to make this further change, and I may add that the Committee which had the proposal before them reported unanimously against it." The agricultural correspondent of the *Times* points out in Tuesday's issue, what we urged on many occasions when the "daylight saving" principle was under discussion, namely, that agricultural interests were ignored by it. Referring to the introduction of summer-time in the fourth week of March, he remarks:—"The drawback is that much of the early morning work at the homestead—the grooming and feeding of horses, the feeding and milking of cows, and the dispatching of the milk—will have to be done by artificial light, which means additional expense, and the prolongation of the period of dark mornings makes the farm less attractive for those whom it employs. The dairy farmer is especially affected, and there are cases in which milk production has been abandoned chiefly because of the labour trouble arising from the operation of the Daylight Saving Act. The most serious disadvantages suffered by the farmer, however, occur from June onwards. The early dews that are no great hindrance at seed-time are a definite hindrance to progress when the work of saving the crops begins. From the time when haymaking is begun in June until the last of the cereals is gathered in September or later, an hour in the late afternoon is often worth two in the morning; yet the farmer finds himself compelled to make good at the cost of overtime the hour that has been deducted from the morning of his normal day. Because of the ad-

verse effect on the harvesting of the crops the extension of the period in September is far more perturbing than the earlier beginning, although both are prejudicial to the farmer and his work."

MR. THOMAS TYRER, who died suddenly on February 20, at seventy-five years of age, received his early chemical training under Hoffmann at the Royal College of Chemistry. In 1862 he was employed as works chemist by Messrs. May and Baker, manufacturers of fine chemicals, of Battersea, and later became managing director of the firm. For the past eighteen years he controlled the works bearing his name at Stratford, established in 1844, where a number of fine chemicals and pharmaceutical preparations are manufactured. Mr. Tyrer was very intimately associated with the Society of Chemical Industry since its foundation in 1881. He was a member of the original Publication Committee, on which he served continuously until his death, for many years hon. secretary of the London Section, and president for the session 1897-98, as well as having been chairman of the London Section, and serving on the council during the greater part of the existence of the society. Since 1907 he had been hon. treasurer of the society, a position which he filled with great ability. His devotion to the society throughout was very notable, and he spent a large amount of time in furthering its interests. In recognition of his services to the society and to chemical industry, the society's medal was presented to him in 1910. Mr. Tyrer served on the governing board, and also on the executive, of the National Physical Laboratory, and he was a member of the council of the Association of British Chemical Manufacturers. For many years, too, he took a very active part in the efforts to secure relief from the duty on alcohol for use in arts and manufactures, which eventually resulted in considerable concessions being obtained from the Inland Revenue. He was keenly interested in the Chemical Section of the London Chamber of Commerce, of which he was chairman at one time, and took an active part in the work of the Alcohol Motor Transport Council. It may also be mentioned that he was one of the first members of the old London School Board. Mr. Tyrer was a man of remarkable personality and great energy; he was widely known in chemical, industrial, and pharmaceutical circles, and will be greatly missed.

DR. C. D. WALCOTT, secretary of the Smithsonian Institution at Washington, has been elected correspondent of the Paris Academy of Sciences in the section of mineralogy in succession to Sir Archibald Geikie, who has been elected foreign associate.

DR. FRANK SCHLESINGER, director of the Allegheny Observatory, has been appointed aeronautical engineer in the U.S. Signal Corps. He will have charge of the instruments that go on aeroplanes, and will form the connecting link between the corps and the National Research Council. During his temporary absence from the observatory Dr. Frank C. Jordan will be in charge.

THE work hitherto done by the Economy Section of the Ministry of Food has now been allotted to four new branches of the Ministry, as follows:—(1) Public Services Food Consumption Branch: Director, Major G. Henderson; (2) National Kitchens Branch: Director, Mr. C. F. Spencer; (3) Public Catering Branch: Director, Mr. A. Towle; (4) Educational Branch: Director, Prof. E. H. Starling. The co-ordination and control of the policy of these Departments will be exercised by a Board to be called the Food Survey Board, of which Lt.-Col. A. G. Weigall will be chairman.

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WE record with regret the death, on February 23, of Lord Brassey, in his eighty-third year. Lord Brassey was best known, perhaps, for his voyages in the *Sunbeam*. In 1879 he was president of the Royal Statistical Society, and in 1893-95 president of the Institution of Naval Architects. He was the founder and first editor of the *Naval Annual*, and the author of several works on social economics.

WE regret to see, in the *Chemical Trade Journal*, the announcement of the death, from injuries caused in a cycling accident, of Prof. E. A. Letts, professor of chemistry in the Queen's University, Belfast. He was a fellow of the College of Surgeons and of the Royal Sanitary Institute. In 1876 he was appointed the first professor of chemistry in University College, Bristol. Among his numerous writings are "The Pollution of Estuaries and Tidal Waters" and "Some Fundamental Problems in Chemistry."

THE death is announced, in his seventy-third year, of Mr. C. E. Faxon, who had been assistant director of the Arnold Arboretum, Jamaica Plain, Mass., since 1882. Mr. Faxon was best known as a botanical artist. He was selected by the Smithsonian Institution to make the drawings for Sargent's "Silva of North America." He had also illustrated Sargent's "Forest Flora of Japan" and "Manual of the Trees of North America," Eaton's "Ferns of North American Garden and Forest," and many other botanical publications.

MR. C. R. DODGE, who for ten years was in charge of the museum of the U.S. Department of Agriculture, died recently in his seventy-first year. In 1890 that department appointed him as its special agent to conduct important fibre investigations. He was the author of twenty special reports on that subject, and also of a "Dictionary of the Fibre Plants of the World." Mr. Dodge represented the United States at the Paris Exposition of 1900 as director of its agricultural commission. He was a chevalier of the Legion of Honour.

THE annual general meeting of the Institute of Metals is to be held on March 13 and 14 in the rooms of the Chemical Society, Burlington House, Piccadilly, W.1. On the first day, when the meeting begins at 8 p.m., the president-designate, Prof. H. C. H. Carpenter, will be inducted into the chair, and the presidential address will be delivered. On March 14, beginning at 4 p.m., several technical communications will be submitted and discussed.

THE *Engineer* for February 22 announces the death of three well-known members of the Institution of Engineers and Shipbuilders in Scotland: Mr. W. Cuthill, who was late works manager of the Blochairn Works of the Steel Company of Scotland; Mr. J. Kennedy, who for forty years was superintending engineer with the firm of R. MacAndrew and Co., and was a founder and chairman of both the Glengall Ironworks and the British Arc Welding Co.; and Mr. J. A. McKie, who founded the firm of McKie and Baxter, engineers and shipbuilders, of Copland Works, Govan.

THE officers and council of the Physical Society of London for the ensuing session are to be as follows:—*President*, Prof. C. H. Lees; *Vice-Presidents* (in addition to those who have filled the office of president), Prof. J. W. Nicholson, Prof. O. W. Richardson, Dr. S. W. J. Smith, and Dr. E. W. Sumpner; *Secretaries*, Prof. W. Eccles, City and Guilds Technical College, Leonard Street, E.C.2, and Dr. H. Stanley Allen, King's College, London, W.C.2; *Foreign Secretary*, Sir R. T. Glazebrook; *Treasurer*, Mr.

W. R. Cooper; *Librarian*, Dr. S. W. J. Smith; *Other Members of Council*, Prof. E. H. Barton, Mr. C. R. Darling, Prof. G. W. O. Howe, Dr. D. Owen, Mr. C. C. Paterson, Mr. C. E. S. Phillips, Dr. S. Russ, Mr. T. Smith, and Mr. F. J. W. Whipple.

MR. H. G. BEASLEY describes, in the February issue of *Man*, a remarkable form of wooden hook, known as Matau Hokori, from Greenwich Atoll, the greatest length of which is $7\frac{1}{2}$ in. It is the crudest specimen hitherto received from the Pacific, formed from a natural root of a pale-coloured wood, of light weight. The maker scarcely troubled even to remove the notches, and in many places has left the bark intact. The barb is of similar wood, and shows a certain amount of skill in the way it is scarfed to the shank; it was apparently finished with some blunt implement and afterwards with a rasp. The hook is a poor specimen of Polynesian art, but this is not surprising considering the remoteness of this little group of islands and the smallness of the population.

"RECONSTRUCTION and Public Health" is the subject of an article by Mr. E. J. Lidbetter in the *Eugenics Review* for January (vol. ix., No. 4). Mr. Lidbetter points out that public health administration has hitherto been based upon prevention in the economic sense, and is not concerned with the individual, who is dealt with under the Poor Law. He pleads for co-ordination between the public health service and organisations for the treatment of individual sickness, e.g. the hospitals, and the divorce of Poor Law administration in the treatment of the sick independent members of the community.

IN the November issue of the *Journal of the Quekett Microscopical Club* (vol. xiii., No. 81) Mr. W. M. Bale describes a method for the measurement of magnifying powers. The method is as follows:—Measure the exact diameter of the magnified field projected with a camera lucida or Beale reflector at a distance of 10 in. Measure also with the stage micrometer the actual diameter of the field. Then the first figure divided by the second gives the magnifying power. But a small correction has to be made, because in the camera image the magnification is appreciably greater at the marginal portions of the field than near the centre. This varies from 1 mm. with a 4-in. field (101 mm.) to 9 mm. for a 9-in. field (203 mm.), being at the rate of 1 mm. for every $\frac{1}{2}$ -in. increase in the diameter of the field. Mr. Maurice Ainslie gives some further notes on this method, and describes an alternative method by the measurement of the Ramsden disc.

THE annual report on the Agricultural Department, St. Vincent, for the year ended March 31, 1917, contains a further account of the work being done to control the ravages of the cotton-stainer (*Dysdercus delauneyi*, Leth.), which is so serious a pest of cultivated cotton in this island and elsewhere in the West Indies. The life-history of the insect has been carefully studied, and it has been found that the eggs are deposited in masses in the ground and carefully covered over, where they take seven and a half to nine days to hatch. Destruction of eggs in the field unfortunately does not appear to be practicable, and the campaign against the insect has to take the form of destruction of its native food plants. A special Ordinance has been passed, and between August, 1916, and April, 1917, 1542 silk cotton trees (*Eriodendron anfractuosum*), 11,570 "John Bull" trees (*Thespesia populnea*), and several thousand seedlings have been destroyed. Collection of insects, etc., is also suggested among other measures, as the insect has no natural enemy of importance.

THE question of the precise fertilising value of the basic slags of low solubility which are commonly obtained in the manufacture of steel by the basic open-hearth process has attracted considerable attention during the past few years. The annual production of such slags has been recently computed at 750,000 tons, and with the projected extension of the iron and steel industry this output will steadily increase. The low solubility of the phosphate in these slags is partly attributable to the use of fluorspar in the manufacture, and there is some reason to think that the conventional method of assessing the solubility of slags by means of weak citric acid solution is liable to lead to an undervaluation of their merits in comparison with the more highly soluble slags obtained in the Bessemer process. This view apparently receives considerable support from the results of field trials in Essex, the results of which are contributed by Mr. G. S. Robertson to the January issue of the *Journal of the Board of Agriculture*. At each of three experimental centres in the two years of experiment the hay crops obtained with the fluorspar slags compared very favourably with those obtained by the application of the same weight of phosphoric acid (200 lb. P_2O_5 per acre) in the form of slag of high solubility. Results almost as good were also obtained with equivalent dressings of ground mineral (Gafsa) phosphate. At one centre, however, other plots were added on which the phosphates were applied at one-half the above rate, and the fact that the yields on these plots were fully equal to those obtained with the heavier applications suggests that the latter were too heavy to furnish a decisive test of the citric solubility criterion. It is noteworthy, however, that with the lighter application the fluorspar slag showed a distinct advantage over the more highly soluble slag.

THE Summary Report of the Geological Survey of Canada for 1916 (Ottawa, 1917), a volume of 420 pages, records good war service on the part of the staff, both in the forces in Europe and in the ever-widening field of mineral discovery. Tungsten ores, especially scheelite, are recorded from alluvial deposits on granite in the Yukon plateau, where the climate prevents the concentrates that are secured in one summer from being available until the following winter—that is, until they can be removed on sleighs. A similarly interesting touch is given to operations on the tungsten ores (wolfram and scheelite) of New Brunswick, when it is stated that a mill cannot be remodelled until snow makes haulage of material practicable. Magnesite attracts attention in British Columbia (Bridge River district), where it occurs, with separable veins of chalcidony, in serpentine. The Arctic expedition organised by the Survey reports an extensive copper region on Bathurst inlet. In Banks Peninsula native copper occurs amygdaloidally throughout lavas 350 ft. in thickness.

IT is known from the work of Prof. Barkla that the scattering of ordinary X-rays by light elements agrees well with the view that the number of scattering electrons in an atom is about equal to the atomic number of the element as given by Moseley, and that each electron acts as an independent radiating centre; the scattering of the penetrating γ rays of much shorter wave-length is, however, markedly less than the value to be expected on the simple theory, and the scattered radiation is mostly in the direction of the incident rays. In a recent paper Mr. A. H. Compton (*Journ. Wash. Acad. Sci.*, January 4) attacks this problem from a new point of view. He supposes that the simple theory of scattering no longer holds when the wave-length is comparable with the linear dimensions of the electron. For purposes of calculation he takes the electron to consist of a sphere of positive electricity, each part of

which can scatter independently, and may be capable of rotational motion. On these assumptions he is able to explain the diminution of scattering with decrease of wave-length, and to account for the asymmetry of the scattered rays. Mr. Compton concludes that the electron must have an effective radius of 2.3×10^{-10} cm.—a value nearly a thousand times greater than the ordinarily accepted radius, calculated from the apparent mass of the electron. He uses in these calculations the data given by Sir Ernest Rutherford and Dr. Andrade on the wave-length of the γ rays, and does not seem to have known of a recent paper by the former in which it is estimated that the wave-length of the most penetrating γ rays from radium is probably less than one-tenth of the lowest value recorded by Rutherford and Andrade. This would make the estimated radius of the electron about one-tenth of the value given by Mr. Compton, but still much larger than the usual value.

In a series of communications to *Terrestrial Magnetism*, Prof. Carl Störmer, of Christiania, has described his photographic determination of auroral heights made in 1913. An account of the earlier communications has already appeared in our columns. The two most recent papers of the series, appearing in March and September, 1917, give an account of Prof. Störmer's theoretical investigations. In a brief historical note he assigns to Goldstein the distinction of having been the first to suggest that an electrical discharge from the sun is the common cause of aurora and magnetic storms. The mathematical problem which Prof. Störmer has set himself treats the earth as an elementary magnet, and as the sole source of a magnetic field traversed by electric corpuscles. A complete solution has not been found even of this simplified problem, but trajectories can be calculated by graphical and numerical integration, and conclusions as to the limiting forms of trajectories can be derived from the general equations. Prof. Störmer accepts for the observed angular radius of the zone of maximum auroral frequency 23° . The values given by his calculations are, for cathode rays 2° to 4° , for β rays 4° to 6° , and for α rays 16° to 19° . The calculated values assume, for the respective rays, such properties as have been actually observed in the laboratory. Prof. Birkeland, the chief supporter of the negative corpuscle theory, suggested, to meet the difficulty, that corpuscles from the sun had velocities very closely approaching that of light. Prof. Störmer thinks it makes fewer claims on the imagination to attribute aurora to α rays, the theory advocated by Vegard. The occasional appearance of aurora far outside the auroral zone is, he admits, a serious difficulty; but he suggests that during magnetic storms the earth may be encircled by a corpuscular ring of large radius, whose modification of the magnetic field may suffice to bring α rays emanating from the sun much nearer the equator than would otherwise be the case. The measurement of auroral streamers is looked to as likely to elucidate at once the penetrating quality of the rays and the constitution and temperature of the upper atmosphere. Further consideration of this aspect of the problem is reserved for a future paper. Prof. Störmer refers to the probable possession by the sun of a magnetic field and an electric charge as considerable complications of the mathematical problem.

THE report of the Government Chemist on the work of the Government Laboratory shows that a total number of 258,456 samples were examined during the year ended March 31 last. This is an increase of more than 18,000 compared with the previous year. As might be expected, heavy demands upon the labora-

tory have been made by the departments specially concerned with war questions. For the Admiralty, the samples analysed included nearly 7000 specimens of metals—an indication of active constructional work by that department. The War Office samples, more than 22,000, were mainly specimens of foodstuffs examined in connection with the control of supplies for the expeditionary forces, together with anæsthetics and other drugs for the medical branch. Numerous questions relating to contraband trading were submitted by the War Trade Department, the Foreign Office, and the Treasury Solicitor. The services of the laboratory have also been extensively utilised by various committees on work arising out of war conditions. It is noted that there has been a very large increase in the use of alcohol in manufacturing operations during the year.

IN a paper read before the Swiss Chemical Society, and quoted in *La Nature* for January 26, M. Stettbacher discusses the most powerful explosives which it is possible to obtain. Nitro-glycerine, which is now considered as one of the most violent of explosives, develops but 1580 calories per kilogram. Liquid-air explosives, or oxyliques, give as much as 2200 calories, since the liquid oxygen combines directly with the carbon and hydrogen. The combinations of hydrocarbons with ozone (ozonide of ethylene and benzene triozonide), although they do not liberate more heat of explosion, are more "brisant," because of their rate of decomposition. It is thus possible to conceive of still higher explosives. A glycerine trichlorate should develop 3000 calories (twice as much as nitro-glycerine), while a mixture of liquid hydrogen and liquid ozone, if it could be realised in practice, would give about 4500 calories. In considering the relative power of explosives other factors than simply the heat generated must be taken into account, the volume of the gaseous products in relation to the original volume of the explosive, and the time factor being important. With liquids there are strict limitations to their practical applications.

A SERIES of "Monographs on Industrial Chemistry" is being edited for Messrs. Longmans and Co. by Sir Edward Thorpe. The volumes are intended to show how essential is the relation of principle to practice. They will afford examples of the application of recent knowledge to modern manufacturing procedure. They are not intended to cover the whole ground of the technology of the matters to which they relate, and will not be concerned with the technical minutiae of manufacture except in so far as these may be necessary to elucidate some point of principle. Three of the volumes, viz. "The Scientific Use of Coal," Prof. W. A. Bone, "Organic Compounds of Arsenic and Antimony," Prof. G. T. Morgan, and "Edible Oils and Fats," C. A. Mitchell, are announced for appearance in April. "The Zinc Industry," E. A. Smith, and "Colour in Relation to Chemical Constitution," Dr. E. R. Watson, are in the press, and "The Applications of Electrolysis in Chemical Industry," A. J. Hale, "The Natural Organic Colouring Matters," A. G. Perkin and Dr. A. E. Everest, and "Liquid Fuel for Internal Combustion Engines," Sir Boverton Redwood, Bart., and Prof. J. S. S. Brame, are in preparation. In addition, a number of other works have been arranged for.

MESSRS. G. ROUTLEDGE AND SONS, LTD., are about to publish in their "Efficiency Books" "Applied Motion Study: The Efficiency Method Applied to Industrial Preparedness," by Mr. and Mrs. F. B. Gilbreth. Another work for appearance in the same series will be "Wealth from Waste: Elimination of

Waste—A World Problem," by Prof. H. J. Spooner. The same firm also announces "Synthetic Products," by A. R. J. Ramsey and H. C. Weston.

MR. EDWARD ARNOLD announces "Aeronautics in Theory and Experiment," by W. L. Cowley and H. Levy, in which will be chapters on the mathematical theory of fluid motion, the aerofoil, structural parts and controls, strength and construction, the air-screw, and stability.

OUR ASTRONOMICAL COLUMN.

NOVÆ IN THE ANDROMEDA NEBULA.—Including that which appeared in 1885, five novæ in the Great Andromeda Nebula have now been recorded. Two were found by Ritchey on plates taken in 1909, their maximum brightnesses being magnitudes 16.3 and 17.0; these are no longer visible. Another nova, of magnitude 17.5, at a distance of 10' from the nucleus, was found by Shapley on photographs taken in September last year. The latest discovery was made by Ritchey on a negative taken on October 16, 1917 (Publications Astr. Soc. of the Pacific, December, 1917). This star was of about the 18th magnitude, and the distance from the nucleus approximately 255" south and 26" west. On this plate Mr. Shapley's nova was observed to have diminished in brightness by at least two magnitudes in the interval of a month. All the photographs in question were taken with the 60-in. reflector at Mt. Wilson.

NEW VARIABLE STARS.—In Circular No. 201 of the Harvard College Observatory Prof. E. C. Pickering gives details of nineteen new variable stars which have lately been discovered by photographic methods, and of two which were found visually. The brightest images observed range from 8.4 to 13.0, and the faintest from 8.8 to <16. One of the variables is of the Algol type, with a period of 2.89570 days, and two others are Cepheids, with periods of 0.4786 day and 0.365 day. As illustrating the enormous wealth of material available for these investigations, the numbers of photographs examined with reference to the three stars mentioned were 292, 537, and 350 respectively.

Circular No. 202 gives the estimated dates during 1918 of maxima and minima of a large number of long-period variables.

TWO SPECTROSCOPIC BINARIES.—The orbits of the spectroscopic binaries γ Phœnicis and σ Puppis have been investigated by Mr. R. E. Wilson with the aid of photographs taken at Santiago, Chile (Lick Observatory Bulletin, No. 303). γ Phœnicis is a star of magnitude 3.3, Class K5, and has been found to complete a revolution in 193.79 days, the orbit being essentially circular. The semi-amplitude of the velocity-curve is 15.8 km., and the system is receding at the rate of 25.8 km. per sec. γ Phœnicis is the only late-type star at present known to be moving in an orbit of very small eccentricity. σ Puppis is of magnitude 2.99, Class K5, and has a period of 257.8 days. The semi-amplitude is 18.55 km., and the velocity of recession of the system 87.3 km. In this case the eccentricity of the orbit is 0.17.

PROPER MOTION STARS.—In *Astronomische Nachrichten*, No. 4922, Dr. Max Wolf gives particulars of nineteen proper motion stars in the region of the Great Andromeda Nebula, and of five which are near δ Arietis. One of the latter is remarkable as showing the large annual proper motion of 1.74", in the direction 130°; the star is of the 14th magnitude, and is situated in R.A. 3h. 6m. 10s., decl. +18° 23.1' (1875).

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MILITARY AERONAUTICS.

MAJOR BAIRD, in introducing the Air Service Estimates to the House of Commons on February 22, gave an outline of the work which had been done in creating the new Air Force. The works and lands used by the R.F.C. and R.N.A.S. have already been taken over, and co-ordination between the Air Ministry, the War Office, and the Admiralty has been secured by holding weekly conferences of the three staffs. Among the more interesting details of the speech from a scientific point of view are the particulars which Major Baird gave of the activities at the front. After all, the real measure of the success of scientific investigation in aeronautics at home is to be sought in the results achieved in the fighting area. These results were expressed in very concrete form in the speech, and we quote some figures given. In one day on the Western front 127 enemy batteries engaged were under aerial observation, twenty-eight gun-pits were destroyed, eighty more were damaged, and sixty explosions of ammunition were caused. In reconnaissance work nearly 16,000 photographs were taken in one month. Our bombing machines, in short-range operations, dropped an average of 6500 bombs per month, representing a weight of about 120 tons. In addition to these activities, about 150,000 rounds of ammunition per month were used in attacking troops from the air. Such figures as these cannot fail to awaken a sense of the extreme importance of the Air Services in modern warfare; and the first item, viz. the destruction of 127 batteries in a single day, brings home in a very convincing manner the effectiveness of aircraft for the control of artillery. Major Baird warmly commended the work of the Advisory Committee for Aeronautics in furthering the technical side of the subject, and expressed the hope that its valuable labours would add to the efficiency of the new Air Force in the future. The speech met with an enthusiastic reception, which it well deserved, for a more remarkable record of progress in so new a branch of the Services could scarcely be imagined.

La Nature for February 9 contains an interesting article from the pen of Lieut. Jean Abel Lefranc under the title "L'évolution de l'aviation allemande." The author traces the general lines of development of German machines since the beginning of the war. At the commencement of hostilities the most prevalent German type was a heavy biplane of very robust construction as compared with the much lighter machines developed in France. The main tendencies towards improvement in this type have been directed towards a reduction of head resistance by the simplification of the lines of the machine, the adoption of stream-lined fuselages made from three-ply wood, and the elimination of all unnecessary struts and tie-wires leading to the very "clean" design of the present-day machines, but necessitating a somewhat heavy construction. The light single-seaters of the Nieuport type, against which our enemies had to contend, led to the development of the Fokker machine, which in turn gave place to the Albatros D.III. of the present time. The failure of the Zeppelins to realise the aims of their inventor led to the necessity of a heavy bombing machine, and the development of this type has resulted in the Gotha of to-day. M. Lefranc points out the various technical improvements made by the Germans as time went on, such as the adoption of appropriate fin surfaces instead of the large dihedral angle and swept-back wings of the earlier machines, and the introduction of balanced controls to obtain flexibility. The importance of standardisation has been clearly recognised, and the result is seen in the three main types now in use, represented by the Albatros D.III, a light single-seater